A FRICTION LINING

Field of the Invention

The invention relates to a friction lining with a porous fiber layer.

Description of the Prior Art

In order to enable the utilization of the thermal stability of carbon fibers for heat-resistant friction linings it is known (US Pat. No. 5,662,993 A) to use a woven fabric made of strands of twisted carbon fibers which is saturated only partly with a resin solution in order to ensure on the one hand the bonding of the fiber structure which is formed by the woven fabric and which is necessary for a sufficient mechanical strength and to obtain on the other hand a structure with a porosity which is necessary for the discharge of oil by the friction lining. The disadvantageous aspect in said known friction materials is the fact however that as a result of the partial impregnation of the fiber structure with resin there is a likelihood that a part of the pores is closed by the displaced resin during operation, which impairs the discharge of oil by the friction lining. Moreover, the treatment with resin of the fabric made of carbon fibers can lead to an environmental burden by solvents or other volatile hazardous materials, unless special precautions are taken.

SUMMARY OF THE INVENTION

The invention is thus based on the object of providing a friction lining of the kind mentioned above in such a way that the disadvantages following the resin impregnation of the fiber structure are avoided without threatening the mechanical strength of the fiber structure.

This object is achieved by the invention in such a way that the fiber layer consists of a sintered fiber structure made of sinterable fibers.

As a result of the sintering of the fiber structure it is possible to ensure an advantageous bonding of the fibers in the region of their contact points without using a bonding resin, namely under the precondition that the employed fiber material actually allows sintering. Since carbon fibers cannot be sintered, polyimide fibers and/or polyacrylonitrile fibers are used for example which also have a high thermal resistance but are sinterable, so that a friction lining can be obtained with a sintered fiber structure from fibers suitable for this purpose, which fiber structure advantageously fulfils both the requirements concerning thermal stresses as well as with respect to mechanical loads. An additional aspect is that as a result of the sintered connections between the individual fibers of the fiber structure its porosity is maintained, leading directly to a favorable discharge of oil by the friction lining.

The structure of the fiber structure shall ensure a substantially even porosity of the friction lining. For this reason it is recommended to use non-woven materials because such non-woven materials offer a very even distribution of the fibers and thus an even porosity. The strength of the non-woven materials can also be increased by needling the non-woven material prior to sintering. A fiber structure in form of a knitted fabric is also possible. An advantageous distribution of the porosity over the friction lining can thus also be achieved. The knitted, twisted fibers lead to a fiber structure of a respectively high strength which is further increased by the subsequent sintering of the fibers.

In order to enable special surface structures, the surface of the fiber layer can consist of sinterable fibers, preferably polyamide fibers, which are scattered onto a fiber structure and are then sintered. The coefficients of friction which can be achieved with the help of such scattered fibers which assume a different position with respect to the fiber structure and are optionally applied in a preferential direction can be used in order to adjust the friction lining to special frictional conditions. For the same purpose, filling materials which influence the frictional properties can also be incorporated in the fiber structure.

It is finally possible to carbonize the fiber structure after the sintering in order to improve the thermal stability of the fibers and their tensile strength.

For the purpose of producing a friction lining in accordance with the invention one can start out from a non-woven material made of polyimide with a basis weight of between 150 and 1500 g/m^2. After the sintering of this non-woven polyimide material at approximately 330°C, a friction material with a favorable strength is obtained. An even porosity of approx. 40 to 50% can be ensured. This even distribution of porosity not only supports the oil discharge by the friction lining, but also leads to a constant coefficient of friction which certainly exceeds the coefficient of friction of resin-saturated carbon fiber fabrics. Moreover, the noise development of such friction linings is low, which must be regarded as an additional surprising effect.

After the sintering, the friction lining can be subjected to an oxidative, thermal cross linking at 150 to 400°C, preferably 250 to 350°C, during a period of 60 to 120 minutes for example in order to improve the thermal stability of the fibers. If the friction lining thus pre-treated is subject to a carbonization at 300 to 1200°C for 5 to 20 minutes, it is not only possible to further increase the thermal stability and the tensile strength of the fibers, but also advantageously influence the noise behavior because the smearing of the surface of the fiber structure is substantially suppressed. With a further carbonization step at a temperature of 1000°C and 1600°C it is possible to achieve a noticeable increase in the tensile strength of the fibers. It is thus showed that the measures in accordance with the invention ensure a friction lining which meets the high demands concerning resistance to heat and wear and tear without having to omit a high share of pores with an even distribution of the pores.